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SOME STATISTICS RELATING TO RELATIVE HUMIDITY AT ESKDALEMUIR (794 ft. above MSL; DUMFRIESSHIRE) JUNE AND JULY 1929/31/33/35/37

INTRODUCTION

An inquiry relating to the securing of the hay crop led to an analysis of data from Eskdalemuir Observatory which may be of wider interest. Attention was concentrated upon relative humidities of 85% or more, it being assumed that air of 85% would be inequilibrium with grass of moisture content 25% (wet basis) - a moisture level below which the resulting hay could be stacked with resonable safety. A better threshold for safe storage is possibly 20% m.c. (in equilibrium with an atmosphere of 75-80% in humid climates - see Report of A.E.A. Conference, "Farming News" Jan. 2 1960).

Few climatological stations observe humidity more than once daily at 0900 G.M.T. and the following attemtps were made to assess the wider significance of the 09h. observation, viz:

(1) the relationship between the 09h. R.H. and the number of hours in the day (24 hours) when R.H. was 85% or more;

(2) the relationship between the 09h. observation of R.H. and the mean value for the 24 hours;

the period taken being the months of June and July only in the five years 1929/31/33/35/37.

One reason behind the interest in the mean daily R.H. is the suggestion (see "Bin Ventilation" (1945) - H.M.S.O.) that under continuous operation the thermal lag of a large mass of grain - and presumably therefore of grass - will result in a fairly steady temperature of the mass of the material roughly equal to the mean daily temperature of the atmospheric air being fed into the barn: a smoothing of the fluctuation in relative humidity may also be inferred.

RESULTS

(1) Relative Humidity at 09h and Number of hours in day with R.H. $\geq$ 85%

Both relative humidity and number of hours per day are bounded (viz. 0 and 100: 0 and 24 respectively) and successive observations are serially correlated, and it is therefore not justified to follow through all the implications of elementary correlation analysis. However the following results were obtained by the usual procedures.

Let Y = No. of hours in a particular day of 24 hours with R.H. $\geq$ 85%
X = R.H. in % at 09h. on that day

then

June	$Y = .39X - 19$	$r(XY) = .75$
July	$Y = .42X - 20$	$r(XY) = .81$
June and July	$Y = .40X - 19$	$r(XY) = .77$

An estimate of tolerances may be gleaned from the following statements:

(a) For an 09h. R.H. $\leq$ 61% there were no occasions associated with 12 hours or more with R.H. $\geq$ 85%.

(b) For an 09h. R.H. $\geq$ 80% there were less than 3% of occasions associated with 8 hours or less at R.H. $\geq$ 85%.

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(2) Comparison of 09h. Relative Humidity and Mean Daily value

Frequency distribution of Relative Humidity
(5 years 1929/31/33/53/37)

R.H. %	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
09h. readings - June														
	-	-	1	-	5	7	20	19	17	17	11	21	14	18
09h. readings - July														
	-	1	1	-	4	5	6	15	23	26	21	18	17	18
Mean daily readings - June														
	-	-	-	-	-	-	4	18	26	25	29	26	14	8
Mean daily readings - July														
	-	-	-	-	-	-	3	6	15	28	37	37	18	11

If Z = mean daily Relative Humidity

X = associated 09h. value

June	$Z = 0.57X + 35$	$r(XZ) = 0.78$
July	$Z = 0.49X + 44$	$r(XZ) = 0.81$
June and July	$Z = 0.54X + 39$	$r(XZ) = 0.79$

An estimate of the tolerances may be gleaned from the following statements.

(a) When 09h. R.H. $\leq$ 49% there were only 1% of cases with a mean daily R.H. $\leq$ 64%;

(b) When 09h. R.H. $\geq$ 90% there were less than 2% of cases with a mean daily R.H. $\leq$ 84%;

(c) When 09h. R.H. $\leq$ 59% there were only 1% of cases with a mean daily value $\geq$ 75%;

(d) For a mean daily R.H. to be 80% or more the 09h. value in almost all cases, requires to be 65% or greater.

(e) A parallel shift of the regression lines by $\pm$ 10% embraces practically all the observed plots.

R.W. GLOYNE

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